

# EUROPEAN PATENT OFFICE

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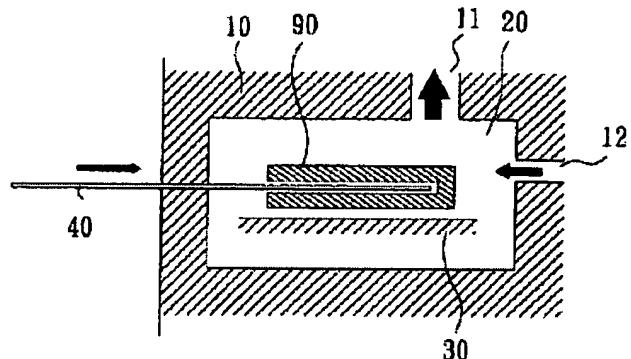
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TITLE : SURFACE HARDENING TREATMENT  
METHOD FOR DEEP HOLE OF PARTS  
IN VACUUM FURNACE



ABSTRACT : PROBLEM TO BE SOLVED: To overcome the following problems in the case where the surface hardening treatment of the inner holes of steel products is performed in the conventional production process; the necessary hardening effect is not obtainable in the deep segments of the holes; there is a need for retreating the waste gas and waste salts used as heat media, and further, the oxidation prevention at a high temperature and saving of labor are needed.

SOLUTION: Parts go, a gas transport pipe 40 and a fixing appliance 30 are cleaned and dried, are installed in the prescribed positions in the heating space within a vacuum furnace and are then heated up to a treatment temperature after the pressure in the heating space of the vacuum furnace is reduced. Treating gas is continuously sent to the deep holes by a transport pipe under slightly higher pressure than the pressure of the heating space and at a suitable flow rate. When the vacuum space is maintained at a set low-pressure state by a vacuum pump, the treating gas is inevitably and forcibly discharged from the walls of the inner holes to the outside of the holes and is simultaneously decomposed and is penetrated and diffused into the walls of the holes. The penetration and diffusion are maintained for a suitable time in order to obtain the sufficient depth of carbonization. Finally, the parts undergoing the carburization or carbonitriding are subjected to treatment, such as cooling, by which the necessary hardened layer is obtained.

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